

### **Remarks**

In the aforementioned amendment, claims 1, 3, 4, 6, 10, 11, 14, 15 and 19-21 have been amended and claim 22 added. Now pending in the application are claims 1-22 of which claims 1, 4, 7, 11, and 16 are independent. The following comments address all stated grounds of rejection. Applicants respectfully urge the Examiner to pass the claims to allowance in view of the amendment to the claims and the remarks set forth below.

### **Claim Amendments**

Claims 1 and 4 have been amended to clarify the scope of the claimed invention. Applicants have amended claim 1 to delete a vertical cavity region and a pumping means. Applicants have also amended claim 1 to recite that the stabilizer module stabilizes modal gains of the multiple modes of the VCSEL by increasing the current through the contact region. Claim 4 has been amended in a same manner as claim 1. Applicants have added new claim 22 reciting that the instability of the modal gains is induced by spatial power instability in the active region. Support for the new claim can be found at originally filed claims 1 and 4. No new matter has been introduced.

### **Claim Objections**

Claims 1, 10, 11 are objected to because of informalities. In response to the objection, Applicants have amended claim 1, 10 and 11 to remove the informalities. In light of the claim amendments, Applicants believe that claims 1, 10 and 11 are in condition for allowance.

### **Claim Rejections-35 U.S.C §112**

Claims 3, 6, 10, 14, 15, 19 and 20 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In response to the rejection, Applicants have amended claims 3, 6, 10, 14, 15, 19 and 20 to replace “used” with -

adapted to use-. In light of the claim amendments, Applicants submit that claims 3, 6, 10, 14, 15, 19 and 20 are in condition for allowance.

Claim Rejections-35 U.S.C. §102

Claims 4 and 6 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,287,366 to Epworth et al. (the '366 patent). Applicants respectfully traverse this rejection.

Claim 4 recites a vertical cavity surface emitting laser (VCSEL) used in a multi-channel system. The VCSEL includes an active region and a contact region in at least one of the active region. The VCSEL also includes a stabilizer module for stabilizing modal gains of the multiple modes of the VCSEL by increasing current through the contact region. Claim 6 depends from claim 4.

The '366 patent discloses an injection laser driver that regulates the bias and modulation depth of an injection laser by means of two feedback control loops. One of the loops derives a feedback control signal from a measure of the mean optical output of the laser. The other derives a feedback control signal from a measure of the spectral purity of that optical output. The feedback is controlled by the parameter, spectral purity, that directly affects the chromatic dispersion penalty of an optical transmission system employing the laser.

Applicants respectfully submit that the '366 patent fails to disclose all of the essential elements of claim 4. The '366 patent fails to disclose the stabilizer module for stabilizing modal gains of the multiple modes of the VCSEL by increasing current through the contact region, as recited in claim 4. The claimed invention increases the current of the VCSEL to achieve the mode stabilization of the VCSEL. For a given laser, the length of the cavity must be an integral multiple of half the wavelength in the cavity. All the wavelengths that satisfy this condition are generally called the modes of the laser.

First, Applicants submit that the '366 patent fails to disclose a VCSEL. The '366 patent discloses an injection laser. The injection laser is also called a semiconductor laser or a diode laser. The injection laser uses semiconductors as the active medium. The injection laser disclosed in the '366 patent is not the VCSEL of the claimed invention.

Additionally, the '366 patent fails to disclose the stabilizer module for stabilizing modal gains of the multiple modes of the VCSEL, as recited in claim 4. The Examiner indicates that the injection laser driver disclosed in the '366 patent corresponds to the stabilizer module of the claimed invention. Applicants respectfully disagree. The claimed invention stabilizes modal gains in the multiple modes of the VCSEL. Stabilization of the gains within various modes of the VCSEL provides similar speed across respective modes. The '366 patent discloses in Fig. 5 the general shape of the coherence characteristics for a single mode laser as a function of optical path difference for four different values of laser drive current, in which 50a and 50d are the smallest and largest of the four currents, respectively. The '366 patent only discloses in Fig. 6 the shape of the coherence characteristics for multilongitudinal mode output. The '366 patent does not disclose the stabilizer module for stabilizing modal gains in the multiple modes of the VCSEL.

Additionally, the '366 patent fails to disclose increasing the current through the contact region to stabilize modal gains of the multiple mode of the VCSEL, as recited in claim 4. The Examiner indicates that the column 2, lines 5-45 of the '366 patent disclose this limitation. Applicants respectfully disagree. The '366 patent only discloses that the drive current of the injection laser is regulated based on the detected spectral purity of the output of the laser. In particular, the '366 patent discloses in Fig. 5 that the shape of the coherence characteristics 50a corresponding to the smallest of the four currents is more stabilized than the others 50b, 50c and 50d. The '366 patent does not disclose that modal gains of the multiple modes of the VCSEL are stabilized by increasing the current of the VCSEL.

In light of the aforementioned arguments, Applicants respectfully submit that the '366 patent fails to disclose all of the essential elements of claim 4. Applicants therefore believe that claims 4 and 6 are in condition for allowance.

Claim Rejections-35 U.S.C. §103

Claims 1-3, 5 and 7-21 are rejected under 35 U.S.C. §103(a) as being unpatentable over the '366 patent and further in view of Applicants' Admitted Prior Art (APA). Applicants respectfully traverse this rejection.

Applicants respectfully submit that the '366 patent and APA fail to teach or suggest all of the limitations of claims 1, 7, 11, and 16. The '366 patent and APA fail to teach or suggest a stabilizer module for stabilizing modal gains of the multiple modes of the VCSEL by increasing current through the contact region, as recited in claim 1. Claims 7, 11 and 16 also recite a similar limitation. The '366 patent only teaches that the drive current of the injection laser is regulated based on the detected spectral purity of the output of the laser. The '366 patent does not teach increasing of the current through the contact region to stabilize modal gains of the multiple modes of the VCSEL.

The Examiner indicates that the '366 patent discloses all of the claim limitations except for the laser being a VCSEL and the VCSEL is disclosed in the 'Background' portion of the pending application. The Examiner therefore concludes that it would be obvious to one of ordinary skill in the art to modify Epworth by employing a VCSEL for the VCSEL's advantageous benefits.

Applicants respectfully disagree. One of ordinary skill in the art will appreciate that one of the problem with a VCSEL is the large ohmic resistance encountered. This lead to considerable heating of the VCSEL and the need for efficient thermal cooling. Many of the dielectric material used to make mirrors have low thermal conductivity. So the use of such dielectric mirrors makes room temperature operation of the VCSEL difficult to achieve since the heat generated by the VCSEL cannot be dissipated easily. In contrast, the injection laser disclosed in the '366 patent does not include the dielectric

mirrors. For this reason, one of ordinary skill in the art will not motivated to modify the teaching of the '366 patent and increase the current to stabilize the modal gains of the multiple modes of the VCSEL because the increased current in the VCSEL require a mechanism for much more efficient cooling.

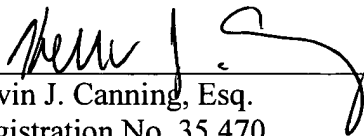
In light of the aforementioned arguments, Applicants respectfully submit that the '366 patent and APA fail to teach or suggest all of the claim limitations of claims 1, 7, 11, and 16. Claims 2, 3, 5, 8-10, 12-15 and 17-21, which depend on one of claims 1, 7, 11 and 16, are not rendered obvious over the '366 patent and APA. Applicants therefore submit that claims 1-3, 5 and 7-21 are in condition for allowance.

**Conclusion**

It is believed that the claims in their current form distinguish over the cited references. Additionally, the introduction of claim 22 to the application introduces no new matter. Should the examiner feel that a telephone conference with Applicants' attorney would expedite prosecution of this application, the Examiner is urged to contact the Applicants' attorney at (617) 227-7400.

Respectfully submitted,

LAHIVE & COCKFIELD, LLP

  
Kevin J. Canning, Esq.  
Registration No. 35,470  
Attorney for Applicants

28 State Street  
Boston, MA 02109  
(617) 227-7400

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